

Alabama's Listening!

UNIVERSAL NEWBORN HEARING SCREENING

Program Guidelines

This program is coordinated by the Alabama Department of Public Health

helping babies develop language for learning and interaction

**State of Alabama
Department of Public Health
Universal Newborn Hearing Screening
Program Guidelines**

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PREFACE

The State of Alabama Department of Public Health prepared this manual as a guide to assist birthing facilities in the development of guidelines and protocols during the implementation of a universal newborn hearing screening program.

According to the National Center for Hearing Assessment and Management (NCHAM), 33 babies are born every day in the United States with permanent hearing loss. Not only is hearing loss the most commonly occurring birth disorder, it is not identified in many of these children until the second year of life or later. Early identification of hearing loss can and/or will affect a child's speech, language skills, and cognitive development; thus, resulting in problems with literacy, oral/aural communication, academic performance and occupational consequences.

Newborn hearing screening is essential in order to identify those children with hearing loss at birth and those children with high risk factors for developing hearing loss, and is becoming a standard of practice across the nation. The Joint Committee on Infant Hearing Screening endorses early detection of and intervention for infants with hearing loss. Endorsements have also been made by the American Academy of Audiology, American Speech-Language Hearing Association, The American Academy of Pediatrics and the American Academy of Otolaryngology, among others.

In February 2001, Governor Don Siegelman and the Alabama Department of Public Health announced a new initiative designed to ensure that every Alabama hospital with birthing facilities would be able to screen for newborn hearing loss. Initially, \$639,440 in grants were provided to 50 birthing facilities to either start or enhance current Universal Newborn Hearing Screening (UNHS) programs. Through the implementation of these grants, the goal is to create and maintain UNHS programs in the State of Alabama in order to track all newborns to ensure early identification, treatment and intervention of infants with hearing loss, who in the past may have gone undetected.

For more information, or questions related to these program guidelines please contact:

**State of Alabama
Department of Public Health
Bureau of Family Health Services
201 Monroe Street
P.O. Box 303017
The RSA Tower
Suite 1350
Montgomery, Alabama 36130-3017**

PROGRAM DEVELOPMENT

- The Alabama Department of Public Health recommends that the newborn hearing screening program be under the supervision of an experienced, qualified and licensed audiologist.
- Each birthing facility will develop policies and procedures in accordance with current recommendations as set forth by the Joint Committee in Infant Hearing Screening Position Statement (2000).
- Each birthing facility will be responsible for selecting and obtaining appropriate equipment for screening purposes according to current standards (see Appendix B Selecting Equipment).
- Each birthing facility must ensure that sufficient and qualified staff is available to conduct the screening, prior to the infant's discharge. (This recommendation is not discipline-specific because the key to screening is appropriate training and supervision. The experiences of other states support this recommendation).
- The birthing facility is responsible for assuring that an initial hearing screening is performed on every newborn prior to discharge.
- Data will be recorded on the infant's initial PKU Filter Paper Form by hospital personnel and forwarded to the Bureau of Clinical Laboratories for reporting purposes.
- The birthing facility will establish a plan to inform the infant's responsible party of resources available to them for further testing and treatment, including habilitation services for infants, as needed.

POLICIES AND PROCEDURES

Each birthing facility will be responsible for creating and implementing policies and procedures specific to that facility's newborn hearing screening program. These policies and procedures should include, but not be limited to: screening procedure, guidelines for training qualified personnel, performance maintenance (PM) checks of newborn hearing screening equipment, quality improvement indicators, and data management. Policies and procedures should be reviewed annually and should address the following:

Personnel and Training:

- Identify who is responsible for training screening personnel
- Document all job descriptions, qualifications, and roles and responsibilities for each newborn hearing screening position (e.g. audiologist, nurse, technician, etc.), as well as orientation, minimum length of training, competency validation in regard to screening proficiency.
- It is recommended that the discharge planner be responsible for notifying parents and primary medical physician verbally and in writing of the patient's screening results. In addition, it is recommended that the discharge planner be responsible for scheduling outpatient hearing screenings as necessary.

Equipment:

- Identify the name, model and type of testing equipment being used for screening purposes. Care, use, trouble-shooting, maintenance and servicing of the testing equipment should be included.
- Identify safety measures and infection control practices.

Inpatient Screening Protocol:

- A copy of the policy and procedure manual for newborn hearing screening will be located in close proximity to the screening site and be readily available to staff involved with newborn hearing screening.
- Identify the optimal testing environment as well as the desired condition or state of the newborn during testing.
- Identify the title of the staff person responsible for notifying the responsible party of a "refer" screening result (e.g. the primary medical care provider, audiologist, technician or nurse) and identify the method of such notification.
- Identify risk indicators associated with hearing loss that may necessitate the

need for continued surveillance (see Appendix C, Risk Indicators).

- All birthing facilities should have Policies and Procedures in place specific to their facility. Facilities should also perform in-house quality assurance/improvement on a quarterly basis.
- Hospitals will use a “general consent” to perform hearing screenings granted the consent is broad enough to cover this service. It is advised that each facility consult with their legal representation to ensure that the general consent is appropriate to cover this service.

Resources:

A “Qualified Provider Directory” will be made available to all birthing facilities, related professionals, and parents upon completion.

- Training may be provided by:
 1. The State Newborn Hearing Screening Coordinator at (334) 206-2944 at the Alabama Department of Public Health.
 2. The Resource Coordinator at the Alabama Ear Institute at (205) 879-4234.
 3. By any certified audiologist.

In addition nurses who are well versed in hearing screening may train other personnel at their birthing facility. A check list is to be maintained at each birthing facility to ensure proper training. (See Appendix A, Hearing Screening Training Checklist).

PERSONNEL AND TRAINING

Staff training should include the purpose and scope of care of the birthing facility's newborn hearing screening program. Identification of the roles, responsibilities, assigned tasks and scope of care and limitations of the duties of the screener should also be included. Training will be performed by qualified personnel (e.g., audiologists and/or persons who have had experience in newborn hearing screening). This training should be hands-on and competency based.

The training of personnel should include the following:

- A review of general nursery policies and procedures.
- A review of safety and infection control guidelines.
- Baby-handling instruction.
- Education on the use, care, maintenance and trouble-shooting of screening equipment being used.
- Instruction regarding documentation of screening results.
- The method of notifying the primary medical care provider and responsible party of screening results and follow-up recommendations as necessary.

Training may be provided by:

1. The State Newborn Hearing Screening Coordinator at (334) 206-2944 at the Alabama Department of Public Health.
2. The Resource Coordinator at the Alabama Ear Institute at (205) 879-4234.
3. By any certified audiologist.

In addition nurses who are well versed in hearing screening may train other personnel at their birthing facility. A check list is to be maintained at each birthing facility to ensure proper training. (See Appendix A, Hearing Screening Training Checklist).

Criteria to be a newborn hearing screening trainer are to include:

- demonstration of a referral rate of no more than 6% for a period of three months.
- completion of a minimum of 100 hearing screenings.

- attendance at a formal training session conducted by a certified audiologist.

*It is recommended that birthing facilities train and employ a limited number of personnel to perform hearing screenings in order to insure consistent and competent staff.

EQUIPMENT

- Each birthing facility will be responsible for selecting and securing appropriate equipment according to standards, for screening all newborns for hearing loss prior to discharge (See Appendix B, Selecting Equipment).
- Technology utilized must:
 - ✓ Measure a physiologic response.
 - ✓ Be implemented with objective criteria.
 - ✓ Measure the status of the peripheral or peripheral and central auditory system that is highly correlated with hearing status.

Acceptable methodologies for physiologic screening include evoked otoacoustic emissions (EOAE), either transient or distortion product, and automated auditory brainstem response (AABR). These techniques can be performed either alone or in combination. Both are noninvasive, quick, and easy to perform, although each assesses hearing differently.

- Each birthing facility is responsible for the development and implementation of a newborn hearing screening policy and procedure protocol that includes the care, use and maintenance of the screening equipment. The policy should be reviewed on an annual basis.
- Calibration, service and maintenance of the equipment should be completed on an annual basis. These records will be readily accessible and will be housed in the birthing facility.

INPATIENT SCREENING PROTOCOL

During the maternity stay, a designated hospital staff member will:

- Inform parents of the hospital's universal newborn hearing screening program.
- Obtain informed consent for hearing screening from parents and/or primary caretaker(s) using the **Hospital's general consent**.
- Complete newborn hearing screening waiver if parents or responsible party refuses screening

All newborns will have at least one hearing screening prior to discharge.

The screening should be conducted after stabilization and be performed in as quiet a room as possible. It is recommended that the screening be conducted using one of the following physiologic screening methods: automated auditory brainstem response (AABR) and/or otoacoustic emissions (OAE's), either transient or distortion product.

A two-stage screening method is recommended for all birthing facilities performing newborn hearing screenings. The two-stage method involves the newborn receiving a second (and sometimes multiple) screening(s), in house, prior to discharge and prior to referral.

For those birthing facilities having combination OAE/AABR screening units: the two-stage screening method recommended would involve screening initially with OAE and followed-up with AABR as necessary prior to referral.

Newborns who pass the initial screening do not need to be screened again while in the hospital.

All newborns will be assessed for risk indicators for delayed onset or progressive hearing loss as outlined by the Joint Committee on Infant Hearing Screening in the Position Statement (2000), (see Appendix C, Risk Indicators).

Screening personnel will document screening results on the PKU Filter Paper Form. This form will include information specific to hearing screening including:

- Date of screening
- Time (military)

- Identify risk indicators present
- Method of screening (AABR or OAE)
- Ear specific results (right and left)
- Documentation of a “refused” screen
- Documentation of a screen “not performed”

Follow-up Procedures on Newborns who PASS the Inpatient Screening

1. Newborns who PASS and no risk indicator(s) is identified:
When any newborn with no risk indicator passes prior to discharge a designated hospital staff member will:
 - A. Provide parents/primary caretaker(s) with documentation that reiterates screening results.
 - B. Provide parents with ***Alabama’s Listening*** hearing development brochure which describes delayed onset and progressive hearing loss and details typical developmental milestones and encourages parents to contact the child’s primary medical care provider, or an audiologist to seek further testing if hearing loss is suspected in the future.
 - C. Notify the Alabama Department of Public Health (ADPH) and the patient’s primary medical care provider of screening results.

2. Newborns who PASS and one or more risk indicator(s) are identified:
When any newborn passes prior to discharge and one or more risk indicator(s) are identified, a designated hospital staff member will:
 - A. Provide parents/primary caretaker(s) with screening results, as well as information regarding the late onset of hearing loss due to risk indicator(s) present. Also provide parents with recommendations for follow-up, along with ***Alabama’s Listening*** hearing development brochure.
 - B. Notify the ADPH Newborn Hearing Screening Coordinator and the patient’s primary medical care provider of screening results and risk indicator(s) present, which warrant follow-up and monitoring.
 - C. Follow-up for this population will include:
 1. A letter sent by the ADPH as confirmation of screening results, risk indicator(s) present and the need to follow-up with continued surveillance at six month intervals until age three and every year

thereafter until age five.

2. Tracking and data management of babies/children identified with risk indicator(s) for hearing loss will be performed by the ADPH.
3. Appropriate diagnostic audiological and medical evaluation should be completed as outlined in the “Outpatient Screening/Diagnostic Protocol and Guidelines” portion of this document should an infant/child fail a hearing screening.

Follow-up Procedures on Newborns who FAIL the Inpatient Screening

In the event that, prior to discharge, the newborn fails the initial and repeated screen(s), a designated hospital staff member will:

- A. Provide parents/primary caretaker(s) with screening results, as well as information regarding the late onset of hearing loss. Also provide a copy of the “**Outpatient Screening and Diagnostic Reporting Form**” (See Appendix F) for follow-up (re-screen within two weeks as an outpatient), along with *Alabama’s Listening* hearing development brochure.
- B. Notify the ADPH Newborn Hearing Screening Coordinator and the patient’s primary medical care provider of screening results and risk indicator(s) present.

Follow-up for this population will include:

1. A letter shall be sent by the ADPH as confirmation of screening results, risk indicator(s) present and the need to follow-up within two weeks for an outpatient re-screen.
2. Tracking and data management of infants who fail the inpatient newborn hearing screen will be performed by the ADPH.

Follow-up Procedures on Newborns who are NOT Screened Prior to Discharge (i.e. “not performed”)

In the event that the newborn is discharged prior to receiving the initial hearing screen, a designated hospital staff member will:

- A. Document a “not performed” screen on the PKU Filter Paper Form (See Appendix E, PKU Filter Paper Form).
- B. Provide parents/primary caretaker(s) with information regarding how to schedule an outpatient screening, provide a copy of the “**Outpatient Screening and Diagnostic Reporting Form**”, as well as providing the

parents/primary caretaker(s) with an **Alabama's Listening** hearing development brochure.

- C. Provide the ADPH Newborn Hearing Screening Coordinator and the patient's primary medical care provider with documentation of a screen "not performed."

Follow-up for this population will include:

1. A hearing screening should be scheduled within two weeks of discharge with data being reported to the ADPH Newborn Hearing Screening Coordinator for tracking and data management.
2. Screening results obtained following discharge will be reviewed and tracked appropriately based on "PASS" or "FAIL" criteria by the ADPH.

Follow-up Procedures on Newborns who are NOT Screened Due to Refusal by Parents and/or Primary Caretaker(s):

If any newborn is not screened prior to discharge due to parental and/or primary caretaker refusal, then a designated hospital staff member will:

1. Document a "refused screen" on the PKU Filter Paper Form.
2. Provide parents/primary caretaker(s) with information regarding newborn hearing screening and an **Alabama's Listening** hearing development brochure and a copy of the "**Outpatient Screening and Diagnostic Reporting Form**".
3. Provide the ADPH Newborn Hearing Screening Coordinator and the patient's primary medical care provider with documentation of a "refused screen."

Follow-up for this population will include:

A letter shall be sent by the ADPH with information describing the importance of NHS and recommendations for an outpatient screen within one month of discharge.

OUTPATIENT SCREENING/RESCREENING AND DIAGNOSTIC

PROTOCOLS

All infants/children, regardless of newborn hearing screening outcome, should receive ongoing monitoring for development of age-appropriate auditory behaviors and communication skills. Any infant/child who demonstrates delayed auditory and/or communication skills development should receive audiologic and medical evaluation to rule out hearing loss (Joint Committee on Infant Hearing Screening Position Statement, 2000).

Infants/children who meet the defined referral criteria listed below should receive an outpatient hearing screening/rescreening by a certified audiologist:

- Infants who do not “Pass” the initial inpatient newborn hearing screening prior to discharge.
- Infants who were discharged prior to receiving the birth admission newborn hearing screening.
- Infants/children who demonstrate developmental communication delays at any time.

Follow-up Procedures on Infants/Children who PASS the Outpatient Screening

1. Infants/children who PASS and no risk indicator(s) is identified, screening personnel will:
 - A. Provide parents/primary caretaker(s) with documentation that reiterates screening results.
 - B. Provide parents/primary caretaker(s) with ***Alabama’s Listening*** hearing development brochure which describes delayed onset and progressive hearing loss and details typical developmental milestones and encourages parents to contact the child’s primary medical care provider or an audiologist to seek further testing if hearing loss is suspected in the future.
 - C. Notify the ADPH and the patient’s primary medical care provider of screening results using the “**Outpatient Screening and Diagnostic Reporting Form,**” (See Appendix E).
2. Infants/children who PASS and one or more risk indicator(s) are identified,

screening personnel will:

- A. Provide parents/primary caretaker(s) with screening results, as well as information regarding the late onset of hearing loss due to risk indicator(s) present. Also, provide parents/primary caretaker(s) with recommendations for follow-up, along with **Alabama's Listening** hearing development brochure.
- B. Notify the ADPH and the patient's primary medical care provider of screening results and any risk indicator(s) associated with hearing loss, which warrant follow-up using the "**Outpatient Screening and Diagnostic Reporting Form,**" (See Appendix F).

Follow-up for this population will include:

1. A letter sent by the ADPH as confirmation of screening results, risk indicator(s) present and the need to follow-up with continued surveillance at six month intervals until age three and every year thereafter until age five.
2. Tracking and data management of babies/children identified with risk indicator(s) for hearing loss will be performed by the ADPH.
3. Rescreening of infants/children, if at any time, the parents/primary caretaker(s) voice concern re: the child's hearing.

Follow-up Procedures on Infants/Children who FAIL the Outpatient Screening

1. In the event that an infant/child fails an outpatient hearing screening, screening personnel will:
 - A. Provide parents/primary caretaker(s) with screening results, as well as information regarding implications of possible hearing loss. Also provide parents/primary caretaker(s) with recommendations for diagnostic Audiology/Medical evaluation:
 - Diagnostic Audiology/Medical evaluation follow-up will be completed according to the following guidelines:
 - ✓ By three months of age for infants.
 - ✓ Within two weeks for infants/children failing an outpatient screening during monitoring and/or continued surveillance.
 - B. Notify the ADPH and the patient's primary medical care provider of screening results using the "**Outpatient Screening and Diagnostic Reporting Form,**" (See Appendix F).

Follow-up for this population will include:

1. A letter shall be sent by the ADPH as confirmation of screening results and the need to follow-up with diagnostic audiological and medical evaluation.
 2. If hearing loss is confirmed, hearing aids shall be fit according to the following guidelines:
 - By six months of age for infants.
 - As soon as possible for all other infants/children with confirmed hearing loss.
 - Based on type, degree and etiology (if known) of hearing loss.
 3. Tracking and data management of infants/children who fail the outpatient hearing screening will be performed by the ADPH.
- C. Refer infant/child to “Child Find” for possible eligibility in Alabama’s Early Intervention System (AEIS) at 1-800-543-3098 due to existing hearing loss.

RECOMMENDED DIAGNOSTIC AUDIOLOGICAL ASSESSMENT PROTOCOL FOR INFANTS/CHILDREN

Infants/children who meet the defined referral criteria listed under the previous section will be referred for comprehensive audiologic assessment and specialty medical evaluation to confirm the presence of hearing loss and to determine type, nature, options for treatment, and (whenever possible) etiology of the hearing loss (Joint Committee on Infant Hearing Screening Position Statement, 2000).

The audiological test procedures indicated below are age-specific and are recommended for use with infants/children and are consistent with protocols recommended by the Joint Committee on Infant Hearing. A battery of audiological tests is suggested as no single procedure has sufficient reliability to stand alone. Parents/primary caretaker(s) should be present and participate in the administration of all assessment procedures.

Age of Child

0-6 Months

Audiological Procedures

*Child and family case history/Parent observation report.

*Otoscopic examination.

*Acoustic immittance: tympanometry, physical volume, and acoustic reflexes (Using a higher probe tone, i.e., 1000Hz).

*Otoacoustic emissions—distortion product and/or transient evoked emissions.

*Auditory brainstem response—click and tone bursts (500 and 4000Hz) stimuli by air and bone conduction.

*Behavioral observation audiometry (BOA)/Visual reinforcement

Audiometry (VRA) depending on the child's developmental age.

6 Months – 2 Years

*Child and family case history/Parent observation report.

*Otoscope examination.

*Acoustic immittance: tympanometry, physical volume, and acoustic reflexes.

*Otoacoustic emissions—distortion product and/or transient evoked emissions—for continued monitoring of cochlear function.

*Auditory brainstem response—click and tone bursts (500 and 4000Hz) stimuli by air and bone conduction—may still need to be used to monitor individual ear thresholds if reliable individual ear results cannot be obtained, especially in the presence of an asymmetric hearing loss.

*Behavioral observation audiometry (BOA)/Visual reinforcement audiometry (VRA) depending on the child's developmental age.

2 Years – 5 Years

*Child and family case history/Parent observation report.

*Otoscope examination.

*Acoustic immittance: tympanometry, physical volume, and acoustic reflexes.

*Conditioned Play Audiometry—to include pure tones from 250-8000Hz by air conduction and 250-4000Hz by bone conduction, speech awareness and/or

reception thresholds if possible.

*Otoacoustic emissions—distortion product and/or transient evoked emissions—for continued monitoring of cochlear function.

5 + Years

*Child and family case history/Parent observation report.

*Otoscope examination.

*Acoustic immittance: tympanometry, physical volume, and acoustic reflexes.

*Standard audiometry— to include air and bone conduction, speech reception thresholds and speech/word recognition.

*Otoacoustic emissions— for continued monitoring of cochlear function.

**RECOMMENDED MEDICAL PROTOCOL FOR INFANTS/CHILDREN WITH
CONFIRMED HEARING LOSS**

1. Primary Medical Care Provider
 - A. Activities
 1. Initiates and supervises evaluation and referral process.
 2. Referral sources include ENT and/or Otology, Genetics, Audiologists and Therapists.
 - B. Notification sent to parents/primary caretaker(s) and the ADPS Newborn Hearing Screening Coordinator.
 - C. Important Historical Factors
 1. Exposure to ototoxic medications.
 2. Significant complications during pregnancy.
 3. Immunization to Rubella.
 4. Syphilis screening.

5. Maternal drug use.
6. History of spontaneous abortions.

D. Perinatal High-Risk Indicators

1. Family history of childhood sensorineural hearing loss.
2. Congenital infection known or suspected to be associated with sensorineural hearing loss, such as toxoplasmosis, syphilis, cytomegalovirus, bacterial meningitis, and herpes.
3. Craniofacial anomalies, including morphologic abnormalities of the pinna and ear canal.
4. Hyperbilirubinemia to degree that exchange blood transfusion needed.
5. An illness or condition requiring admission of 48 hours or greater to a NICU.
6. Stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss.
7. Persistent pulmonary hypertension of the newborn associated with mechanical ventilation.
8. Conditions requiring the use of extracorporeal membrane oxygenation.

E. Post-Natal High Risk Indicator(s)

1. Family history of childhood sensorineural hearing loss.
2. Infections associated with sensorineural hearing loss including bacterial meningitis.
3. Recurrent or persistent otitis media with effusion for at least three months.
4. Head trauma.
5. Stigmata or other findings associated with a syndrome known to include a sensorineural or conductive hearing loss or Eustachian tube dysfunction.

6. Neurodegenerative disorders, such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich's ataxia and Charcot-Marie-Tooth syndrome.
7. Craniofacial anomalies, including morphologic abnormalities of the pinna and ear canal.
8. Congenital infection known or suspected to be associated with sensorineural hearing loss, such as toxoplasmosis, syphilis, cytomegalovirus and herpes.
9. Parental/primary caretaker(s) concern regarding hearing, speech, language, and/or developmental delay.

2. ENT/Otology

A. History: Prenatal, Perinatal, Family and Behavioral

B. Physical Examination

1. Structure (auricle, ear canal and surrounding structures).
2. Microscopic examination (ear canal, tympanic membrane, middle ear)

C. Head and Neck Examination

1. Structural Abnormalities, e.g., microcephaly
2. Other congenital abnormalities, e.g., white forelock

D. Review prior testing

1. ABR, OAE and other test results available.
2. Possible need for additional repeat testing.
3. Tympanometry (high probe frequency).

E. Laboratory Evaluation

1. CMV, FTA(if family history of syphilis), renal, thyroid (if indicated), toxoplasmosis.
2. Urinalysis (if history of progressive hearing loss in males or gross hematuria).

- F. Special testing as indicated
 - 1. EKG (if family history of heart disease or abnormality detected on exam).
 - 2. High resolution CT Scan of temporal bone on all babies with diagnosed sensori-neural hearing loss.
 - 3. MRI brain and CPA (only if indicated)
- G. Medical Referrals
 - 1. Genetics referral for all diagnosed babies, including connexin-26
 - 2. Ophthalmology referral for all diagnosed babies
 - 3. Audiology referral for further diagnostic testing or amplification
- H. Additional Referrals (as necessary)
 - 1. Speech/Language evaluation
 - 2. PT/OT evaluation
 - 3. Social Services
- I. Data Management
 - 1. Report to primary medical care provider
 - 2. Report to ADPH Newborn Hearing Screening Coordinator
 - 3. Report to Alabama's Early Intervention System or other specialists as indicated by physician.

FOLLOW-UP FOR CONFIRMED HEARING LOSS IN INFANTS/CHILDREN

The following should be completed by six months of age for infants and as soon as possible for all other infants/children with confirmed hearing loss (See Appendix D, Pediatric Amplification Guidelines).

1. If a bilateral/unilateral sensorineural or permanent hearing loss of 30dB* or greater in the better ear is detected, refer the infant/child to an ENT/Otologist for an examination and medical clearance. (See Recommended Medical Protocol included previously in this document).

***The Year 2000 Joint Committee on Infant Hearing Screening Position Statement recognized hearing loss as being “permanent bilateral or unilateral, sensory or conductive hearing loss, averaging 30 to 40dB or more in the frequency region important for speech recognition (approximately 500 through 4000Hz).”**

2. If significant air/bone gaps are present or if other evidence of middle ear disease is seen, i.e., click-evoked ABR is normal, but OAE results are abnormal, refer the patient to an ENT/Otologist for evaluation and treatment. Repeat the diagnostic evaluation following medical treatment.
3. If results indicate a mixed hearing loss, refer the infant to an ENT/Otologist for evaluation, treatment, and medical clearance as necessary. Begin the process of fitting amplification if appropriate and repeat the diagnostic evaluation following medical treatment.
4. If the ABR threshold is significantly elevated or the morphology is abnormal (i.e., prolonged interpeak latencies) and OAE results are normal, refer the infant to an ENT/Otologist for evaluation of possible retrocochlear dysfunction (auditory neuropathy). Repeat the diagnostic evaluation to monitor neuromaturation.
5. If a unilateral hearing loss is detected with normal hearing sensitivity in the “good” ear, provide the family with information regarding the effects of unilateral hearing loss on auditory, speech, and language skills, as well as the importance of hearing conservation for the “good” ear. Continued audiologic monitoring of the child’s hearing and speech/language development is recommended every six months until the age of three and every year thereafter until age five. Also, consider amplification options and refer the infant/child to an ENT/Otologist for evaluation, treatment, and medical clearance, if appropriate.

QUALITY ASSURANCE

Quality Assurance for hospital-based programs should be implemented in order to ascertain whether a program is achieving expected benchmarks and outcomes. Data management and tracking should be used via quality assurance benchmarks and indicators to improve services to infants and their families. Information obtained while using an effective information management system allows for the accurate and timely description of services provided to each infant.

Benchmarks and quality indicators should be evaluated monthly and should be consistent with existing data such as those referenced in the American Academy of Pediatrics Newborn Hearing Screening Policy Statement and the Joint Committee on Infant Hearing 2000 Position Statement.

Benchmarks are used to evaluate progress by having identifiable goals that are useful in monitoring and evaluating a program. Benchmarks should include the following:

- ✓ A minimum of 95% of all babies will be screened during their birth admission or prior to one month of age.
- ✓ Refer rate should not exceed 10% and should average 1-4%.
- ✓ Return for follow-up rate should be 70% or more.

Quality Indicators are used to help ensure program efficacy, program consistency and stability and will include the following percentages:

- ✓ Babies screened during the birth admission.
- ✓ Babies screened before one month of age.
- ✓ Babies who do not pass the inpatient screen.
- ✓ Babies who do not pass the outpatient screen.

Quality indicators for hospital-based programs should be monitored monthly by the ADPH Newborn Hearing Screening Coordinator to ascertain whether a program is achieving expected benchmarks and outcomes (targets and goals). Frequent measures of quality permit prompt recognition and correction of any unstable component of the screening process.

GLOSSARY

- ***Audiologist***—means a person who is licensed by the State of Alabama to provide audiological services.
- ***Automated auditory brainstem response***—means an objective electrophysiologic measurement of the peripheral auditory system to acoustic stimulation of the ear, obtained with equipment, which automatically provides a pass/refer outcome.
- ***Automated evoked otoacoustic emissions***—means an objective physiologic response from the cochlea, obtained with equipment, which automatically provides a pass/refer outcome.
- ***Diagnostic audiologic evaluation***—means physiologic and behavioral procedures required to evaluate and diagnose hearing status.
- ***Discharge***—means release from the hospital after birth to the care of the parent/primary caretaker(s).
- ***Evoked otoacoustic emissions***—means an objective response generated from the cochlea, and may include click evoked otoacoustic emissions and/or distortion product otoacoustic emission test procedures.
- ***Follow-up***—means appropriate services and procedures relating to the confirmation/absence of hearing loss and appropriate referrals to an audiologist for infants/children with abnormal or inconclusive screening results.
- ***Hearing loss***—means a dysfunction of the auditory system of any type or degree that is sufficient to interfere with the acquisition and development of speech and language skills.
- ***Hearing screening***—means an objective physiological measure to be completed in order to determine the likelihood of hearing loss.
- ***High risk or at risk***—means considered to be in a status with a significant probability of having or developing hearing loss as a result of the presence of one or more factors identified or manifested at birth.
- ***Incomplete result***—means that the infant/child should be referred for a follow-up diagnostic audiological evaluation. This could include uncooperative infant/child, debris in ear canal and excess miogenic activity.
- ***Infant***—means a child under the age of one year.

- **Initial hearing screening**—means the procedure(s) employed for the purpose of screening hearing prior to discharge.
- **Miss or not performed**—means an infant did not have a hearing screening prior to discharge.
- **Neonatal intensive care services**—means those services provided by a hospital's newborn services that are designed as both specialty level and subspecialty level.
- **Primary medical care provider**—means the person to whom the infant/child will go for routine medical care following hospital discharge.
- **Qualified staff (Personnel)**—means a certified audiologist or someone who is already experienced with screening equipment being utilized.
- **Referral**—means to direct an infant/child who does not pass a hearing screening to an audiologist for appropriate diagnostic procedures to determine the existence and extent of hearing loss as well as for appropriate habilitation of a hearing loss.
- **Risk indicator/factor**—means an indicator/factor known to place an infant/child at increased risk for being born with or developing a hearing loss, including but not limited to any one of the risk indicators outlined in the JCIH 2000 Position Statement. (See Appendix B, Risk Indicators).

APPENDIX A

NEWBORN HEARING SCREENING TRAINING CHECKLIST

AOAE Training Checklist

Date: _____

Employee Name: _____

Screening Trainer: _____

- Verifies that all components are plugged into the system
- Turns on the equipment
- Confirms the identity of the infant to be screened
- Follows hospital sanitation procedures
- Swaddles and positions the infant properly for the test
- Selects appropriate probe size tip
- Positions ear tip onto probe correctly
- Inserts probe tip into ear properly
- Selects the appropriate test ear
- Initiates the test
- Adjusts probe fit as needed based on software feedback
- Periodically monitors status of ear probe
- Demonstrates ability to disassemble and clean the ear probe as needed
- Recognizes and troubleshoots:
 - ▶ Excessive acoustic noise in room
 - ▶ High test artifact due to infant activity level
- Pauses test when conditions warrant due to:
 - ▶ Excessive, prolonged infant crying or activity
 - ▶ Ear probe becomes disconnected
- Recognizes when to terminate screening due to infant state
- Prepares or prints out report and other documentation as needed
- Rescreens ear with “refer” results as defined by hospital UNHS protocol

AABR Training Checklist

Date: _____

Employee Name: _____

Screening Trainer: _____

- Verifies that all components are plugged into the system, i.e., electrode leads, probe stimulus, etc.
- Verifies that the infant is not connected to the system by electrodes during power up and power down of the system
- Turns on the equipment
- Loads the AABR program
- Confirms the identity of the infant to be screened
- Enters the demographic information into the computer
- Follows hospital sanitation procedures
- Swaddles and positions the infant properly for the screening test
- Attaches electrode leads in the appropriate montage
- Selects appropriate probe tip size
- Positions ear tip onto probe correctly
- Inserts ear tip into ear adequately
- Selects the appropriate test ear
- Initiates the test
- Adjusts electrodes and skin contact as needed based on software feedback
- Periodically monitors status of ear probe and electrodes during the test
- Demonstrates ability to disassemble and clean the probe as needed
- Recognizes and troubleshoots the following:
 - ▶ Excessive acoustic noise in room
 - ▶ High test artifact due to infant activity level
- Pauses test when conditions warrant due to:
 - ▶ Excessive, prolonged infant crying or activity
 - ▶ Electrode or ear probe becoming disconnected
- Recognizes when to terminate screening due to agitated infant state
- Prints out report and performs other documentation as necessary
- Rescreens ear with “refer” results as defined by hospital UNHS protocol

APPENDIX B
SELECTING EQUIPMENT

SELECTING EQUIPMENT

*** The following information taken from the National Center for Hearing Assessment and Management–Utah State University (4/17/01)**

Since the National Institutes of Health (NIH) Consensus Development Conference on Early Identification of Hearing Loss in Infants and Young Children recommended that all newborns be screened for hearing loss before being discharged from the hospital, there has been a dramatic increase in the number of hospitals performing newborn hearing screening. If that rate of increase continues, as expected, newborn hearing screening will be the standard of care in this country by the year 2000.

The rapid expansion of universal newborn hearing screening programs has brought into focus questions about the most appropriate technique for newborn hearing screening. Through the 1980's, the approach recommended by most people (including the Joint Committee on Infant Hearing [JCIH], the American Speech-Language Hearing Association [ASHA], and the American Academy of Audiology [AAA] was to identify children who were at risk for hearing loss (this comprised approximately 10% of the population) and to use conventional auditory brainstem response (ABR) to determine whether those children had hearing losses. However, data from multiple studies showing that only about half of all children with congenital hearing loss exhibited any of the risk factors, coupled with the emergence of new techniques for screening, has caused most people to abandon the risk factor approach to newborn hearing screening. Instead, the vast majority of newborn hearing screening programs are now using automated auditory brainstem response (AABR), distortion product otoacoustic emissions (DPOAE), or transient evoked otoacoustic emissions (TEOAE). Equipment in each of these categories is currently being used in successful newborn hearing screening programs. But which technique is best?

Although this is probably the most frequently asked question by people considering the implementation of a hospital-based newborn hearing screening program, the fact that there are so many different programs being conducted successfully with equipment in each of these categories suggests that the answer to the above question is not simple or straight forward. Indeed, because the characteristics of these techniques are so heterogeneous, there is probably not a definitive answer about which type of equipment is best. Individual hospitals will have to continue making their own decision, and there may well be situations where one type of equipment is best for the situation of one hospital, while a different type of equipment is best for the situation of another hospital.

The purpose of this brief document is to outline some of the issues that should be considered in selecting equipment. It would be good if there were definitive information for each of those issues. Unfortunately, such definitive information does not exist for

many of these issues. What we have are results of a few studies and a lot of opinions based on clinical experience. This information has been supplemented by the experience the NCHAM staff have had in working the various units in a clinical setting. It should be noted, however, that to maintain our objectivity and independence, NCHAM receives *no* financial support from manufacturers of newborn hearing screening equipment for this website or our technical support and training activities.

The following summarizes the research evidence and the clinical experience related to various types of newborn hearing screening equipment to help people select equipment to use in their own newborn hearing screening program.

Hearing Screening Equipment Available
****Taken from the National Center for Hearing**
Assessment and Management (4/17/02)

Manufacturer	Equipment Name	Technology Type			NCHAM Loan Program
		AABR	DPOAE	TEOAE	
Bio-logic Systems Corp	A*Baer	X	...	...	...
	AuDX I, AuDX II	...	X	...	(see details)
	Scout Sport	...	X	X	...
Etymotic Research	Ero*Scan	...	X	...	...
Everest Biomedical Instruments	Audioscreener	X	X	...	...
Grason-Stadler Inc (GSI)	GSI 70	...	X	...	...
Intelligent Hearing Systems	Smart Screener	X	...	...	...
	Smart OAE	X	X	...	...
Madsen Electronics	Capella	...	X	X	...
	EchoScreen	...	...	X	(see details)
Natus Medical Inc	ALGO 2e	X	...	...	...
	ALGO Portable	X	...	...	...
Otodynamics Ltd	Echoport | Plus	...	...	X	...
	Echocheck	...	...	X	...
	TEi	...	...	X	...
	DP Echoport | Plus	...	X	X	...
	88 DPi	...	X	...	...
	ILO 96 | ILO 88	...	...	X	(see details)
SLE	SABRe	X	...	...	...
SonaMed Corp	Clarity	X	X	...	(see details)
Starkey Laboratories Inc	DP 2000	...	X	...	...

APPENDIX C
RISK INDICATORS

HIGH-RISK INDICATORS

*Adapted from the Year 2000 Joint Committee on Infant Hearing Position Statement

- An illness or condition requiring admission of 48 hours or greater to a NICU.
- Stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss.
- Family history of permanent childhood sensorineural hearing loss.
- Craniofacial anomalies, including those with morphological abnormalities of the pinna and ear canal.
- In-utero infection such as cytomegalovirus, herpes, toxoplasmosis, or rubella.
- Parental or caregiver concern regarding hearing, speech, language, and/or developmental delay.
- Stigmata or other findings associated with a syndrome known to include sensorineural or conductive hearing loss or Eustachian tube dysfunction.
- Postnatal infections associated with sensorineural hearing loss including bacterial meningitis.
- Neonatal indicators—specifically Hyperbilirubinemia at a serum level requiring exchange transfusion, persistent pulmonary hypertension of the newborn associated with mechanical ventilation, and conditions requiring the use of extracorporeal membrane oxygenation (ECMO).
- Syndromes associated with progressive hearing loss such as Neurofibromatosis, osteopetrosis, and Usher's syndrome.
- Neurodegenerative disorders, such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich's ataxia and Charcot-Marie-Tooth syndrome.
- Head trauma.
- Recurrent or persistent otitis media with effusion for at least three months.

APPENDIX D

PEDIATRIC AMPLIFICATION GUIDELINES

Pediatric Amplification Guidelines

The following should be completed by three months of age for infants with confirmed hearing loss.

1. Qualifications for Pediatric Hearing Aid Services.
 - A. A “Medical Clearance” must be obtained from an ENT/Otologist prior to hearing aid fitting.
 - B. An audiologist must complete a diagnostic audiologic assessment.
 - C. An audiologist is the professional singularly qualified, working with an otolaryngologist, to select and fit all forms of amplification for infants and children, including personal hearing aids, FM systems, cochlear implants and other assistive listening devices.
 - D. An audiologist must have the appropriate Alabama licensure in Audiology issued by the Alabama Board of Examiners for Speech-Language Pathology and Audiology in order to practice in the State of Alabama.
 - E. It is preferred that audiologists working with infants and children have experience in the management and fitting of amplification in infants and children with hearing loss. The audiologist should have the necessary equipment to complete the tests required for hearing aid selection and evaluation procedures.
2. Criteria for Determining the Candidacy for Amplification.

Infants should be fit to the “best estimate” audiogram based on the completion of the physiological assessment techniques outlined in the “Audiological Assessment Protocol” section of this document. Amplification decisions should be based on information obtained from on-going audiologic re-evaluation, performance of the infant in the home and/or educational environment, existence of other special needs, speech, language, and auditory developmental milestones, and the family’s preferences.

 - A. Permanent, bilateral hearing loss of >30dB or greater for behavioral testing or >30 dBnHL for click ABR threshold in the better ear. The degree of hearing loss may be determined by either:
 1. Estimates form electrophysiologic correlates of hearing sensitivity (i.e., click or frequency-specific results),

OR WHEN POSSIBLE.

2. Ear specific behavioral thresholds obtained by standard audiometric techniques appropriate to the child's developmental level (i.e., visual reinforcement audiometry, condition play audiometry, or standard behavioral audiometry).
 3. Bilateral mixed hearing loss greater than 30 dB HL. The degree and type of hearing loss should be determined by the factors listed above (see 1 and 2).
 4. Unilateral hearing loss greater than 30dB. The degree and type of hearing loss should be determined by the factors listed above (see 1 and 2).
3. Pre-selection: Physical Characteristics of Amplification
- A. Amplification options:
1. Behind-the-ear (BTE) aids are appropriate for most Infants and children. In-the-ear (ITE) hearing aids are not recommended for use with infants and young children due to the growth of the outer ear, problems with increased feedback and safety issues.
 2. A bone conduction hearing aid may be appropriate if the hearing loss is conductive and BTE hearing aids cannot be worn due to medical or physical contraindications.
 3. Body aids should only be used when BTE hearing aids cannot be fit due to medical or physical contraindications.
 4. A cochlear implant may be appropriate if the child has a bilateral profound/severe sensorineural hearing loss and has used appropriate, binaural hearing aids, has been enrolled in Alabama's Early Intervention System and exhibits minimal benefit from the hearing aids.
 5. An FM system coupled with the infant's personal hearing aids should be considered when the child becomes mobile and needs to listen to a caretaker/teacher at a greater distance.
 6. Hearing aids with digital processing, including an FM system and dual microphones, should be considered for their flexibility and their noise reduction algorithms.

7. Hearing aids with multiple channels should be considered when the audiometric configuration requires the shaping of gain or output in specific frequency regions.
 8. Directional microphones should be considered for children with mild to severe hearing losses to improve signal-to-noise ratio when FM technology, the system of choice to improve signal-to-noise ration, is not being used.
- B. Amplification safety feature requirements:
1. Tamper resistant battery doors
 2. Volume control covers
- C. All amplification fittings should be binaural in children, unless contraindicated.
- D. It is recommended that families be provided with maintenance kit that includes:
1. Dry aid kit
 2. Battery tester
 3. Listening tube/stethoscope
 4. Extra batteries
4. Hearing Aid Selection and Verification:
- A. Prior to direct evaluation of the hearing aid on the child, the hearing aid should be preset and evaluated in a hearing aid test box to average age-related real-ear to coupler difference (RECD) values.
 - B. The preferred verification method is to use probe microphone measurements and the child's ear, ear mold, and amplification system. The procedure should be combined with a prescriptive technique, which estimates target responses appropriate for the characteristics of the amplification system.
5. Validation of Aided Auditory Function Should be On-Going and Should Include:
- A. Audiologic assessment directly measuring the child's performance

including aided soundfield responses to speech and frequency specific stimuli.

- B. Functional auditory skill assessment obtained by the audiologist and early interventionist.
 - C. Speech, communication, and language skill assessment obtained by the early interventionist and a speech/language pathologist.
 - D. Parent input as well as input from other professionals involved with the child.
6. Counseling and Follow-up:
- A. Information about all appropriate amplification options should be given to the parents prior to final purchase of amplification.
 - B. Parents and other family members or individuals that will assist in the insertion of and maintenance of the amplification system should receive orientation and on-going support.
7. Suggested Frequency of Audiologic Re-evaluation/Follow-up
- A. At least every three to six months during the first two years of amplification use.
 - B. Every three to six months after the first two years of amplification use.
8. The infant/child should be enrolled in Alabama's Early Intervention System.

APPENDIX E
PKU FILTER PAPER FORM

ALABAMA NEWBORN SCREENING PROGRAM

Alabama Department of Public Health
 Bureau of Clinical Laboratories
 8140 ALM Drive, PO Box 244078
 Montgomery, AL 36124-4078

STATE LAB...260-3400

Patient (Last) _____ (First) _____ (M)		Infant's ID# (Hospital Pat. Acct.# or County HD UMR#)	
Birthdate	Time of Birth (Military)	Birth Weight (Current WT. if > 1mth.) lbs. _____ oz. _____	Multiple Births Birth Order A, B, C etc. _____
Date of 1st Feeding (Military)	Time of 1st Feeding (Military)	Type Feeding <input type="checkbox"/> Breast <input type="checkbox"/> Regular <input type="checkbox"/> Soy <input type="checkbox"/> TPN <input type="checkbox"/> OTHER: _____	Check if <input type="checkbox"/> Premature <input type="checkbox"/> Black <input type="checkbox"/> White <input type="checkbox"/> Asian <input type="checkbox"/> Hispanic <input type="checkbox"/> Other
Date of Collection (Military)	Time of Collection (Military)	Antibiotics <input type="checkbox"/> First Test <input type="checkbox"/> Second Test	Sex <input type="checkbox"/> M <input type="checkbox"/> F
Mother (Last) _____ (First) _____ (M)	Mother (Maiden) _____	Mother's Age _____	Date Hepatitis B Vaccine Given DATE / /
Mother's Social Security Number	Mother's Medicaid Number	Mother's Phone No. _____	HEARING DATE / /
Mailing Address	City	County	Date _____ Time (Military) _____ Risk Factors: _____ Method: <input type="checkbox"/> ABR <input type="checkbox"/> OAE Right Ear: <input type="checkbox"/> Pass <input type="checkbox"/> Refer Left Ear: <input type="checkbox"/> Pass <input type="checkbox"/> Refer <input type="checkbox"/> Refused <input type="checkbox"/> Not Performed
Physician (Last) _____ (First) _____ (M)	State	Zip	
S U A B D M R I T E S R		AL Zip Form # CL-89 000018	

APPENDIX F

**OUTPATIENT SCREENING AND DIAGNOSTIC REPORTING
FORM**

Reporting Form for Outpatient Screening/Diagnostic Audiological Evaluation

Baby's Name: _____ Date of Birth: _____

Birth Hospital: _____ Medical ID#: _____

Parent or Guardian Contact Information:

Baby's Primary Care Physician:

Name: _____ Name: _____

Address: _____ Address: _____

Phone: _____ Phone: _____

-

Outpatient Screening Facility:

Name: _____ Date of Referral _____

Address: _____

_____ Phone: _____

Hearing Screening Results Attached Yes No

Results Right Ear []Pass []Refer

Left Ear []Pass []Refer

Date of Screening _____

Technology used _____

To the Screening Facility: Please complete the reverse side of this form and return it to:

Alabama Department of Public Health
Newborn Hearing Screening Program
P. O. Box 30317
Montgomery, Alabama 36130-3017
Phone: (334) 206-2944

The completed form should be returned as soon as the outpatient hearing screening/initial diagnostic audiological evaluation is completed, but no later than 4 weeks from the date of the referral.

Results of Diagnostic Audiological Evaluation

Results of Audiologic diagnostic evaluation for _____
(Name of Child)

	Right Ear	Left Ear
Normal Hearing	<input type="checkbox"/>	<input type="checkbox"/>
Conductive Loss	<input type="checkbox"/>	<input type="checkbox"/>
Sensorinural Loss Mild	<input type="checkbox"/>	<input type="checkbox"/>
Moderate	<input type="checkbox"/>	<input type="checkbox"/>
Severe	<input type="checkbox"/>	<input type="checkbox"/>
Profound	<input type="checkbox"/>	<input type="checkbox"/>

Date of Evaluation: _____

Diagnostic Evaluation Report Attached: Yes No

Comments: _____

Signature of Audiologist

Address

Address

Phone

Please return form when initial diagnostic audiological evaluation is completed to:

Alabama Department of Public Health
Newborn Hearing Screening Program
P. O. Box 30317
Montgomery, Alabama 36130-3017
Phone: (334) 206-2944